impactFUL BRIEFS

Guide to Recognizing and Preventing Heat Stress Damage

A Component-by-Component Checklist for Multi-Site Facility Managers Overseeing Commercial HVAC Equipment Across Retail, Veterinary, Automotive, Storage, and Healthcare Locations

How to Use This Guide

This tool helps multi-site facility managers identify heat stress warning signs on key HVAC components before those conditions produce failures during peak summer demand. Use Part 1 as a pre-summer inspection reference - either to conduct internal audits or to verify that service vendor inspection reports address the specific conditions that heat stress produces. Use Part 2 as a portfolio tracking tool to document findings and remediation across all locations. Use Part 3 to establish the service vendor standards that make heat stress prevention consistent and visible across the entire portfolio.

Target: All pre-summer inspections completed and all identified warning signs addressed before sustained peak heat demand begins. In high-heat markets including the Southwest, Southeast, and Sun Belt, target completion before June 1.

PORTFOLIO INFORMATION

Field	Details
Portfolio Name / Organization	
Number of Locations	
Sectors Represented	☐ Retail ☐ Veterinary ☐ Automotive Dealership ☐ Storage ☐ Healthcare ☐ Other: _____
Primary Equipment Types	☐ Rooftop Packaged Units ☐ Split Systems ☐ Both ☐ Other: _____
High-Heat Markets in Portfolio	List states or regions: _____
Primary Service Vendor	
Vendor Contact for Pre-Summer Scheduling	
Pre-Summer Inspection Target Completion Date	
Person Responsible for Portfolio Heat Stress Tracking	

PART 1: COMPONENT-BY-COMPONENT HEAT STRESS CHECKLIST

Use this checklist during pre-summer inspections or to verify service vendor inspection coverage. Each component section includes what heat stress does to that component, the warning signs that indicate heat stress conditions are developing, the preventive actions that address those conditions, and the escalation threshold that indicates immediate service is required.

COMPONENT 1: COMPRESSOR

What Heat Stress Does: Rising ambient temperatures increase condensing pressures, forcing the compressor to generate more heat of compression to move refrigerant through a larger pressure differential. As compression ratios rise, compressor discharge temperatures increase. When discharge line temperatures exceed 225 degrees Fahrenheit, the system risks oil breakdown, acid formation inside the refrigerant circuit, and valve wear that can produce permanent compressor damage. The compressor is the highest-cost component in the system and the one whose failure most reliably produces location downtime.

Warning Signs - Check Each

Warning Sign	Observed	Not Observed	Notes
Discharge line temperature above 200°F at current ambient conditions - measured with temperature clamp on discharge line	☐	☐	

Compressor amp draw above nameplate amperage	☐	☐	
High-side pressure significantly above expected range for current ambient temperature	☐	☐	
System short-cycling - compressor starting and stopping repeatedly rather than running in sustained cycles	☐	☐	
High-pressure safety tripping and resetting during operation	☐	☐	
Compressor running but not achieving setpoint during peak afternoon heat	☐	☐	
Unusual sounds from compressor during operation - rattling, grinding, or abnormal mechanical noise	☐	☐	
Compressor housing significantly hotter than expected at current conditions	☐	☐	

Preventive Actions

☐ Verify refrigerant charge is correct for current conditions - check superheat and subcooling against manufacturer specifications. An undercharged system raises compression ratios and discharge temperatures simultaneously.

☐ Verify condenser coil is clean and airflow through the coil is unrestricted - fouled coil is the most common cause of elevated head pressure that stresses the compressor

☐ Verify condenser fan operation - a non-operating condenser fan rapidly elevates condensing pressure and discharge temperature

☐ Document discharge line temperature and compressor amperage at current ambient as baseline for comparison during summer

Escalation Threshold: Discharge line temperature above 225°F, high-pressure safety actively tripping, or compressor showing abnormal sounds requires same-day service contact. Do not reset a tripping high-pressure safety without identifying and correcting the cause.

COMPONENT 2: CONDENSER COIL

What Heat Stress Does: The condenser coil rejects heat from the refrigerant circuit to outdoor air. When fin spaces are blocked by dust, debris, cottonwood, pollen, or biological growth, airflow through the coil is reduced and heat transfer efficiency drops. The system compensates by raising condensing temperature and pressure - beginning the cascade of elevated compression ratios and discharge temperatures that leads to compressor stress. A fouled condenser coil is the most common initiating condition for heat stress failure across commercial HVAC equipment.

Warning Signs - Check Each

Warning Sign	Observed	Not Observed	Notes
Visible debris, dust, cottonwood, or biological growth on coil fin surfaces	☐	☐	
Coil fin surfaces compressed or damaged - reducing effective airflow area	☐	☐	
Condenser approach temperature significantly above expected range - the difference between condensing temperature and outdoor ambient temperature	☐	☐	
High-side operating pressure above expected range for current ambient temperature	☐	☐	
Location reporting adequate morning cooling but inability to maintain setpoint during peak afternoon heat	☐	☐	
Reduced clearance around condenser unit from vegetation, equipment, or stored materials blocking airflow	☐	☐	
Evidence of recirculated discharge air entering coil intake - unit installed near wall or obstruction that returns hot exhaust air	☐	☐	

Preventive Actions

☐ Clean condenser coil fins physically - not surface rinse only. Embedded debris between fin rows requires proper cleaning solution and technique to remove. Surface rinsing moves visible material but leaves embedded fouling that continues to impair airflow.
☐ Confirm minimum two-foot clearance around all sides of condenser unit - remove any obstructions, stored materials, or vegetation within clearance zone
☐ Inspect for discharge air recirculation conditions - unit placement near walls or in enclosures that return hot exhaust air to the intake should be flagged for corrective action
☐ In markets with heavy cottonwood or allergen seasons, schedule a follow-up coil inspection after heaviest fouling season passes and before peak cooling demand arrives
☐ Document coil condition rating (clean, light fouling, moderate fouling, heavy fouling) at each inspection for portfolio tracking

Escalation Threshold: Heavy fouling that cannot be adequately addressed during the inspection visit requires scheduled cleaning before peak summer demand. Do not defer condenser coil cleaning to a future routine visit if heavy fouling is confirmed during pre-summer inspection.

COMPONENT 3: CONDENSER FAN MOTOR AND FAN ASSEMBLY

What Heat Stress Does: Condenser fan motors draw hot outdoor air across themselves for cooling while simultaneously moving that air through the condenser coil. On sustained high-heat days, motors operate near their thermal rating continuously. Bearing lubrication thins under heat. Winding insulation degrades over time under sustained high operating temperatures. A condenser fan motor that fails during peak summer operation eliminates heat rejection from the condenser - causing head pressure to rise rapidly and the high-pressure safety to trip within minutes. Fan blade damage reduces airflow efficiency and increases motor vibration, compounding both problems.

Warning Signs - Check Each

Warning Sign	Observed	Not Observed	Notes
Bearing noise during operation - grinding, squealing, or unusual mechanical sound	☐	☐	
Fan motor amperage draw above nameplate rating	☐	☐	
Motor housing significantly hotter than expected during operation	☐	☐	
Fan blade(s) visibly bent, cracked, or damaged	☐	☐	
Visible vibration during fan operation - indicating blade imbalance	☐	☐	
Fan motor not running while compressor is operating - most critical warning sign	☐	☐	
Evidence of prior overheating at motor housing - discoloration, melted insulation on leads	☐	☐	
Fan blade rotation direction correct - condenser fan should pull air through the coil and discharge upward or outward	☐	☐	

Preventive Actions

☐ Measure and document condenser fan motor amperage against nameplate at every pre-summer inspection
☐ Listen for bearing noise with unit running - bearing failure is audible before it produces complete motor failure if someone is specifically listening for it
☐ Inspect all fan blades for damage, cracks, or bending - replace damaged blades before summer peak demand
☐ Confirm fan motor rotation direction is correct - a motor wired incorrectly pushes air in the wrong direction and provides no condenser heat rejection
☐ Confirm fan guard screens are clear - blocked screens reduce airflow and add motor load

Escalation Threshold: Any bearing noise during operation, amperage above nameplate, fan motor not running with compressor operating, or visibly damaged fan blades requires service before summer peak demand begins. A non-operating condenser fan is an immediate service need regardless of season.

COMPONENT 4: RUN CAPACITORS

What Heat Stress Does: Run capacitors provide the phase shift that allows compressor and condenser fan motors to start and run. Heat degrades the dielectric material inside capacitors, reducing their capacitance over time. A capacitor that tests within its rated microfarad range in spring may be at the low end of acceptable by early summer and fail completely during the first sustained heat wave - stopping the motor it supports without any external warning sign. Capacitor failure is one of the most common causes of summer HVAC failures across commercial portfolios and one of the most inexpensive to prevent proactively.

Warning Signs - Check Each

Warning Sign	Observed	Not Observed	Notes
Capacitor microfarad reading below 90% of rated value - measured with capacitance meter	☐	☐	Rated value is printed on capacitor label. Reading below 90% of rated value indicates marginal condition.
Capacitor housing swollen, bulging, or leaking - visible physical damage	☐	☐	
Compressor or condenser fan motor humming but not starting - motor attempting to run without adequate phase shift from capacitor	☐	☐	
Capacitor age unknown or estimated beyond 5 years in high-heat markets	☐	☐	
Capacitor housing discolored from heat exposure	☐	☐	

Preventive Actions

☐ Test microfarad value of every run capacitor at every pre-summer inspection - this requires a capacitance meter and takes less than two minutes per capacitor

☐ Replace any capacitor testing below 90% of rated value during the pre-summer inspection visit - do not defer to monitor. The cost of proactive replacement is a fraction of the emergency service call cost when the capacitor fails during a heat wave.

☐ Replace any capacitor with visible physical damage - swelling, bulging, or leaking - immediately regardless of microfarad reading

☐ Document capacitor microfarad readings at each inspection for portfolio tracking - a declining trend across inspections indicates accelerating degradation

☐ In high-heat markets, consider proactive replacement of capacitors testing between 90% and 95% of rated value as a lower-risk policy for locations where summer downtime cost is particularly high

Escalation Threshold: Any capacitor below 90% of rated microfarad value should be replaced during the inspection visit. Any motor humming but not starting should be evaluated for capacitor failure before any other diagnosis.

COMPONENT 5: CONTACTORS

What Heat Stress Does

Contactors are the electrical switching components that energize compressor and condenser fan motor circuits when the thermostat calls for cooling. Each compressor start-and-stop cycle passes current across the contact surfaces, which gradually erode through pitting and arcing. Summer heat waves produce extended runtimes and more frequent cycling as systems struggle to maintain setpoint, accelerating contact erosion. Pitted contacts carry current imperfectly, generating heat at the contact surface that further accelerates erosion. In severe cases, contacts weld

closed - trapping the compressor in continuous operation - or chatter erratically, producing voltage fluctuations that stress connected motor windings.

Warning Signs - Check Each

Warning Sign	Observed	Not Observed	Notes
Contact surfaces visibly pitted, burned, or eroded - visible when contactor is de-energized and contacts are accessible	☐	☐	
Contactor housing discolored from contact heat	☐	☐	
Chattering sound during compressor operation - indicates contacts are not making clean, complete contact	☐	☐	
Contactor coil pulling in but compressor or fan not starting - contacts failing to close completely	☐	☐	
Compressor running continuously without cycling off when thermostat setpoint is reached - may indicate welded contacts	☐	☐	
Voltage drop across closed contacts above acceptable limit - measured with voltmeter	☐	☐	

Preventive Actions

☐ Inspect contact surfaces at every pre-summer inspection - de-energize the unit and visually inspect for pitting, burning, or erosion

☐ Replace contactors showing significant pitting or burn marks during the inspection visit - contactor replacement is a low-cost, low-labor intervention

☐ Note and document contactor condition rating at each inspection for portfolio tracking - light pitting, moderate pitting, heavy pitting, replacement required

☐ In high-heat markets with extended cooling seasons, consider increasing contactor inspection frequency to twice annually for locations with the highest compressor runtimes

Escalation Threshold: Contactors showing heavy pitting, chattering during operation, or evidence of welded contacts require immediate replacement. Do not operate a system with chattering contacts - the voltage fluctuations produced can damage compressor and fan motor windings.

COMPONENT 6: REFRIGERANT CHARGE

What Heat Stress Does: A system operating with low refrigerant charge loses cooling capacity precisely when it is most needed - during peak summer demand. Low charge reduces suction pressure, raises compression ratios, and increases compressor discharge temperatures - compounding the heat stress that elevated ambient temperatures are already producing. A system that was marginally low on charge through a mild spring may show frozen evaporator coils or inability to achieve setpoint as summer heat peaks its demand. Topping off a low system without finding and repairing the leak is a temporary solution that defers the same problem to the next heat event.

Warning Signs - Check Each

Warning Sign	Observed	Not Observed	Notes
Suction pressure below expected range for current conditions and refrigerant type	☐	☐	
Superheat above expected range - indicating insufficient refrigerant in evaporator	☐	☐	
Subcooling below expected range - indicating insufficient liquid refrigerant leaving condenser	☐	☐	
Evaporator coil frosting or icing - indicates refrigerant starvation in evaporator	☐	☐	
System running continuously without achieving setpoint despite adequate airflow and clean coils	☐	☐	

Oil staining at refrigerant fittings, line connections, or coil surfaces - indicates refrigerant leak site	☐	☐	
Prior service records showing repeated refrigerant additions without documented leak repair	☐	☐	

Preventive Actions

☐ Verify superheat and subcooling at appropriate ambient temperature during pre-summer inspection - do not assume charge is correct because it was not recently flagged
☐ Perform leak check at all accessible fittings, connections, and coil surfaces when charge is confirmed low - find and repair the leak rather than adding refrigerant without identifying the source
☐ Document refrigerant charge verification results at each inspection - confirmed correct, adjusted, or leak identified and repaired
☐ Review prior service records for any location that has received repeated refrigerant additions - a pattern of additions without documented leak repair indicates an unresolved leak that will recur during summer peak demand

Escalation Threshold: Any system showing active evaporator icing, suction pressure significantly below expected range, or confirmed undercharge requires service before summer peak demand. A leak that requires refrigerant addition must be repaired - not deferred - before peak season.

PART 2: PORTFOLIO HEAT STRESS INSPECTION TRACKING LOG

Complete one row per location per inspection event. Use to track findings across the portfolio, identify patterns, and confirm that all identified warning signs have been addressed before peak summer demand.

Pre-Summer Inspection Results *(add more rows as needed)*

Location	Sector	Inspection Date	Vendor	Compressor Status	Condenser Coil Status	Fan Motor Status	Capacitor Status	Contactor Status	Refrigerant Status	Warning Signs Found	Actions Required	Actions Completed	Cleared for Summer
				☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag			☐ Yes ☐ No	☐ Yes ☐ No
				☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag			☐ Yes ☐ No	☐ Yes ☐ No
				☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag	☐ OK ☐ Flag			☐ Yes ☐ No	☐ Yes ☐ No

Portfolio Summary - Pre-Summer Heat Stress Status

Metric	Count	Percentage
Total locations inspected		
Locations cleared for summer - no warning signs found		%
Locations with warning signs identified and corrected		%
Locations with warning signs identified - correction pending		%
Locations not yet inspected		%
Locations with compressor warning signs		%
Locations with condenser coil fouling requiring cleaning		%

Locations with capacitors replaced proactively		%
Locations with contactors replaced proactively		%
Locations with refrigerant charge issues found and corrected		%

Pattern Flags - Review When You See:

☐ Same component type flagged at multiple locations in the same market - may indicate a regional environmental condition (cottonwood season, construction dust, high humidity) affecting that component specifically

☐ Same location flagged at multiple consecutive inspections on the same component - indicates an underlying condition that is not being resolved by surface-level remediation

☐ High percentage of capacitors testing marginal across the portfolio - may indicate an aging equipment cohort that warrants proactive replacement program

☐ Multiple locations with repeated refrigerant additions in service history without documented leak repair - each represents an unresolved leak that will produce a peak-season failure

PART 3: SERVICE VENDOR STANDARDS FOR HEAT STRESS INSPECTION

Use this section to establish and confirm the inspection standards that make heat stress detection consistent and portfolio-visible across all locations. Share with service vendors before scheduling pre-summer inspections.

Minimum Inspection Standards - Confirm Before Scheduling

The following measurements and checks must be included in every pre-summer heat stress inspection. A service report that confirms "unit serviced and operating normally" without these specific measurements is not a heat stress inspection - it is a visual check that does not detect the developing conditions that heat stress produces.

Compressor

☐ Discharge line temperature measured and documented at current ambient conditions

☐ Compressor amperage measured and documented against nameplate

☐ High-side and low-side pressures measured and documented

☐ Compression ratio calculated from measured pressures

Condenser Coil

☐ Coil fin surface physically inspected - not just viewed from distance

☐ Coil condition rated and documented - clean, light fouling, moderate fouling, heavy fouling

☐ Clearance around unit confirmed and documented

☐ Coil cleaned if fouling is rated moderate or heavy - cleaning scope confirmed before technician visit

Condenser Fan Motor and Assembly

☐ Fan motor amperage measured and documented against nameplate

☐ Fan motor inspected for bearing noise during operation

☐ Fan blades physically inspected for damage

☐ Fan rotation direction confirmed correct

Run Capacitors

☐ Microfarad value tested and documented for every capacitor - rated value and measured value both recorded

☐ Capacitors below 90% of rated value replaced during visit - not deferred

☐ Physical condition of capacitor housing documented

Contactors

☐ Contact surfaces physically inspected with unit de-energized

☐ Contact condition rated and documented - clean, light pitting, moderate pitting, heavy pitting

☐ Contactors with heavy pitting or burn marks replaced during visit

Refrigerant Circuit

☐ Superheat measured and documented

☐ Subcooling measured and documented

☐ Leak check performed at all accessible fittings and coil surfaces

☐ Any low-charge condition corrected and leak identified and repaired - not just topped off

Report Requirements

☐ All measurements documented with actual values - not just pass/fail notation

☐ Component-level findings noted - not just overall system status

☐ All corrective actions performed during visit documented with parts used

☐ Any conditions requiring follow-up documented with recommended action and timeline
☐ Technician name and certification documented on report

In-Season Heat Stress Monitoring Protocol

Once pre-summer inspections are complete, use this abbreviated check during any in-season maintenance visit or in response to a comfort complaint.

Check	Method	Escalate If:
Condenser coil visual	Walk-by visual inspection	Any visible fouling accumulation since pre-season cleaning
Discharge line temperature	Temperature clamp on discharge line	Above 200°F at current ambient
Compressor amperage	Clamp meter	Above nameplate
Capacitor microfarad	Capacitance meter	Below 90% of rated value
Fan motor - listen	Audible during operation	Any bearing noise
Refrigerant charge indication	Supply and return temperature differential at air handler	More than 5°F above expected differential at current conditions

PART 4: QUICK REFERENCE - HEAT STRESS WARNING SIGNS AND REQUIRED ACTIONS

Post this reference at facilities management office or share with location managers in high-heat markets for use during summer when service coordination is most time-sensitive.

What You Observe	Most Likely Component	Action Required	Timeline
System not achieving setpoint during afternoon peak heat despite running continuously	Condenser coil fouling or refrigerant undercharge	Service call for coil inspection and refrigerant check	Same day
System short-cycling - starts and stops repeatedly	High-pressure safety tripping - likely condenser coil or refrigerant issue	Service call - identify and correct cause before resetting safety	Same day - do not reset safety without identifying cause
Compressor humming but not starting	Capacitor failure	Service call for capacitor test and replacement	Same day
System running but no cool air - no airflow from registers	Condenser fan failure or evaporator freeze-up	Service call	Same day
Ice on refrigerant lines or evaporator unit	Refrigerant undercharge or airflow restriction	Service call - do not continue operating	Same day
Chattering or buzzing sound from equipment cabinet	Contactor issue	Service call	Same day
Compressor running continuously and not shutting off	Possible welded contactor contacts	Service call - shut down unit if safe to do so	Immediately
Unusual grinding or squealing from condenser unit	Fan motor bearing failure	Service call	Same day
Burning smell from equipment	Electrical component overheating - winding or contact issue	Service call - shut down unit	Immediately
High-pressure lockout displayed or indicated	High-pressure safety tripped - condenser coil, fan, or refrigerant issue	Service call - identify cause before restart	Same day - do not restart without identifying cause